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14. ABSTRACT The current report presents an update of results from the previous annual report. A great deal of progress has been made over the past year. The most exciting results are those that focus on the association between self-reported risk and protective factors in the Army STARRS New Soldier Survey (NSS), which was administered during reception week, and subsequent administrative records showing that the new soldiers in the NSS either were perpetrators or victims of Military Sexual Trauma (MST) over their first two years of Army service. We used machine learning methods to develop optimal prediction equations from the NSS data. Even though final models have not yet been completed, preliminary results are very positive: showing that the 10% of new male soldiers classified as having highest risk of MST perpetration were responsible for 58.3% of all actual MST perpetration that occurred over the next two years, while the 5% of new female soldiers classified as having highest risk of MST victimization were involved in 32% of all actual MST victimization that occurred over the next two years. These percentages can only increase with model refinements that will be made over the next few months. Concentrations of risk as high as these are actionable, as they can be used to target high-risk new soldiers for enhanced preventive intervention efforts aimed at reducing incidence of MST.					
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INTRODUCTION

The primary objective of this project is to carry out secondary analyses of data on risk-protective factors for military sexual trauma (MST) perpetration-victimization in the Army Study to Assess Risk and Resilience in Servicemembers (A-STARRS), the largest epidemiological study of mental health risk and resilience ever conducted among US Army personnel. Although the primary focus of A-STARRS is suicide, much information also exists on other topics, one of them being MST. Using the A-STARRS data, we will estimate the prevalence and predictors of MST perpetration and victimization in order to develop risk prediction tools that can be used by the Army to target soldiers at high risk of MST perpetration or victimization. A secondary objective is to use the results of these analyses to expand knowledge about modifiable risk and protective factors for MST perpetration and victimization in the Army. The latter information could be of value to the Army once targeting of high-risk groups occurs and preventive interventions are developed or modified.

BODY

YEAR 1: A significant problem was encountered in YR1 in the delay in obtaining the Army Omnibus DUA, which governs the crime databases. This delay meant that we were unable to begin analysis until the DUA was finalized in September 2013. However, we did have access to the crime codes and we were able to do conceptual work in organizing the crime codes into categories and writing computer code to streamline variable construction once the databases became available.

- A. Specific Aim 1: Description of the aspects of MST available in the Army STARRS data** – Army STARRS contains both self-reports about MST victimization in our surveys and also administrative data on MST perpetration from Army criminal justice data. We have focused first on administrative records, which are available for all Regular Army soldiers on active duty at any time in the time period 2004-2009, we examined founded cases of sexual violence perpetration as well as reported cases of victimization. We discriminated between physical acts (e.g., rape and attempted rape) and verbal (i.e., sexual harassment) types of MST. We also distinguished first occurrences from repeat occurrences. And we focused on “founded” cases, not mere accusations for which the military police designated the suggestion of perpetration as unfounded. Among men, rates of physical MST perpetration were 282.0/100,000 person-years. (Appendix, Table 1) It is noteworthy that 213.6 of the 282.0 were *first* occurrences, while the remaining 68.4 (roughly 25% of the total) were *repeat* occurrences. The verbal violence perpetration rate among men was much lower than that of physical MST (33.6/100,000 person-years). Rates of MST perpetration were much lower among women than men both for physical MST (26.4 vs. 282/100,000 person-years) and verbal MST (6.0 vs. 33.6/100,000 person-years).

We also looked at prospective rates of MST perpetration in the sample of new soldiers that participated in the Army STARRS New Soldier Survey (NSS) by linking survey responses, which were obtained during Reception Week, with administrative data on perpetration and victimization in the next two years. The number of Regular Army soldiers in the NSS who agreed to record linkage was n=21,825, a number too small to study verbal MST. But perpetration rates of physical MST by the 24th month after beginning basic training were 0.4% among men (roughly 400/100,000 person-years) and less than 0.1% among women (roughly 60/100,000 person-years). (Appendix, Table 2)

We also looked at reported victimization. Just as perpetration was higher among men than women, victimization was higher among women than men. In the full database of all administrative records for the 2004-2009 study period, victimization rates for physical MST were 1,152.0/100,000 person-years among women and 31.2/100,000 person-years among men. Rates of verbal MST were much lower: 61.2/100,000 person-years among women and 4.8/100,000 person-years among men. In the NSS, 4.3% of women reported physical MST victimization within two years of enlistment compared to 0.2% of men.

Analyses of the Army STARRS All Army Survey (AAS) remain to be carried out, as the AAS data are not yet weighted.

An important feature of MST is its age-of-onset (AOO) distribution: the relationship between length of Army service and risk of MST. Given that we have information in the administrative dataset on date of enlistment as well as date of each incident of MST, we were able to generate AOO curves for male perpetration as well as for female victimization. Results are reported in Figure 1 for perpetration, where we see an upwardly bending curve for physical MST and a roughly straight line curve for verbal MST. This means that soldiers are more likely to be perpetrators of physical MST early than late in their careers, whereas risk of perpetration of verbal MST is unrelated to time in service. (Appendix, Figure 1)

Parallel AOO curves for victimization are reported in Figure 2. We see there that male physical MST victimization and female verbal MST victimization have slightly upwardly curving distributions, indicating higher risk in the early years of service. But the female physical MST is very dramatically skewed upward, indicating that virtually all first occurrences of physical MST victimization among female soldiers take place in the first two years of Army service. This means that risk of female physical MST victimization is highly concentrated in time, highlighting the importance of protecting young women early in their careers. (Appendix, Figure 2)

- B. Specific Aim 2: Risk-protective factors for exposure to MST** – We’ve focused up to now on using data obtained in the New Soldier Survey (NSS) during Reception Week to predict physical MST perpetration among men and victimization among women. This has been done so far using machine learning methods (e.g., random forests, penalized regression, super learner) designed to optimize overall prediction accuracy rather than to yield accurate estimates of the coefficients associated with individual predictors. Even though models are as yet preliminary, results were quite strong. This is illustrated in Figure 3, where we show a distribution of actual MST perpetration among men and victimization among women in the NSS as of the first quarter of 2013 broken down by ventile (20 groups of equal size ranked by predicted risk) of predicted risk from the best-fitting preliminary machine learning model. (Appendix, Figure 3) As shown in the figure, the highest ventile of victimization risk is highly elevated. This 5% of newly enlisted women accounted for 27% of all women who were MST victims over the subsequent two years. This result suggests that risk prediction algorithms could be developed based on survey responses obtained in Reception Battalion to allow better tailoring of intensive preventive intervention efforts designed to reduce incidence of MST victimization. We are currently working on the development of a final refined model and short survey that will be able to generate algorithm scores.
- C. Specific Aim 3: The diverse outcomes associated with MST** – We have not yet begun analyses of the adverse effects of MST victimization.
- D. Specific Aim 4: Risk-protective factors for PTSD and other clinically significant emotional problems associated with MST**– We have not yet begun analyses of risk-protective factors for PTSD or other clinically significant emotional problems in the wake of MST victimization.
- E. Specific Aim 5: Risk-protective factors for MST perpetration**– As noted above in Subsection B, machine learning methods were used to predict MST perpetration among male new soldiers from survey information reported in the NSS. As shown in the Figure 3, the two highest ventiles of perpetration risk are highly elevated, with the 10% of male new soldiers classified as having highest perpetration risk subsequently accounting for 58.3% of all perpetration of MST in the two years after the beginning of basic training. This result suggests that a risk prediction algorithm could be developed based on survey responses obtained in Reception Battalion to target a subset of high-risk male new soldiers for intensive preventive intervention efforts designed to reduce incidence of MST perpetration. We are currently working on the development of a final refined model and short survey that will be able to generate algorithm scores.
- F. Specific Aim 6: Barriers to seeking treatment for PTSD and other adverse emotional reactions to MST**– We have not yet started work on this specific aim.

KEY RESEARCH ACCOMPLISHMENTS

- Once approval was received to work with the survey data we began coding those data on self-reported sexual violence perpetration and victimization. This work is now done.
- We have generated a coding scheme to classify offenses in the Integrated Administrative Data File (IADF) and identify which offenses should be categorized as physical and verbal MST. We also developed parallel codes for other types of violence perpetration and victimization based on the belief that physical violence and physical MST perpetration are related, although we have not yet included these measures of other types of violence in the prediction equations. We have generated prevalence estimates for MST in the IADF. We had originally hoped to complete this in the first quarter of 2013, but we were delayed because of not getting approval to work with these data until recently.
- HMS analysts are in the process of generating samples to analyze longitudinal profiles of recurrence of administratively-recorded MST perpetration and victimization in the IADF. We will be sampling first offenses and then among those with one offense, we will generate a sample for predicting a second offense, then among those with two offenses we will generate a sample to predict a third offense, and so on. Once these samples have been created we will look at predictors for a first offense and separately for predictors of multiple offenses.
- We merged NSS data with IADF data and developed preliminary models to predict physical MST victimization (women) and perpetration (men) from survey responses. As noted above, the initial model results are very promising, leading us to focus current efforts on developing final versions of these models for use in future inception cohorts during Reception Week.

REPORTABLE OUTCOMES

- TMA DUA finalized February 26, 2013
- DMDC DUA finalized on June 3, 2013
- Army Omnibus DUA finalized on September 18, 2013
- Development of a comprehensive crime database that includes all reported offenses committed or experienced by all Regular Army soldiers from 2004-2009, and development of self-reported instances of MST victimization among soldiers who participated in Army STARRS NSS, AAS and PPDS.

CONCLUSION

We received final approval for accessing the administrative datasets containing Army criminal justice data for the purpose of this project on September 18, 2013. We first submitted the request in early September, 2012 and spent one year in back and forth communications with the ODUSA trying to gain approval. Due to the delay in obtaining this critical DUA, our work on this project for much of the year was limited to developing code, determining the appropriate classification scheme, and classifying offenses. However, now that we have access to the data, we are in the process of aggressively carrying out the proposed analyses. The first step in our analysis of these administrative data was to examine basic prevalence measures and to study predictors of MST in the first two years of service among soldiers in the NSS. Preliminary results, as reported above, are highly encouraging and we are consequently focused now on developing final versions of these models prior to extending the analyses to the other survey data and the complete IADF. Our next step after completing the final models to predict MST perpetration and victimization using data in the NSS will be to turn to the full IADF to determine whether we can predict perpetration and victimization more completely using IADF variables either instead of or in addition to survey variables. After this work is done we will focus on other specific aims related to consequences and treatment of soldiers exposed to MST.

REFERENCES

N/A

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Table 1. Prevalence of physical and verbal military sexual trauma (MST) perpetration and victimization per year, per 100,000 soldiers. Regular Army 2004-2009. Total number of person months is 37,023,063 (based on weighted sample) males = 31,832,552 females = 5,190,508

	Male			Female		
	(n)	Crime rate per year per 100,000	SE	(n)	Crime rate per year per 100,000	SE
I. Perpetration						
Physical MST ¹						
Total	7477	282.0	3.6	113	26.4	2.4
First occurrence	5678	213.6	2.4	101	22.8	2.4
Repeat occurrences	1799	68.4	1.2	12	2.4	1.2
Verbal MST ²						
Total	897	33.6	1.2	27	6.0	1.2
First occurrence	821	31.2	1.2	27	6.0	1.2
Repeat occurrences	76	0.0	0.0	0	0.0	0.0
II. Victimization						
Physical MST ¹						
Total	836	31.2	1.2	4981	1152.0	19.2
First occurrence	707	26.4	1.2	4044	934.8	16.8
Repeat occurrences	129	4.8	0.0	937	217.2	7.2
Verbal MST ²						
Total	139	4.8	0.0	264	61.2	3.6
First occurrence	136	4.8	0.0	245	56.4	3.6
Repeat occurrences	3	0.0	0.0	19	4.8	1.2

¹Physical MST includes: rape, forcible sodomy, sexual assault, lewd acts with children, and incest

²Verbal MST includes sexual harassment

Table 2. Morbid risk (MR¹) of physical military sexual trauma (MST)² perpetration and victimization among Regular Army New Soldier Survey (NSS) respondents as of 24 months after beginning BCT (n = 21,825)

	Male		Female	
	MR	(n)	MR	(n)
Perpetration	0.4	(41)	0.1	(3)
Victimization	0.2	(17)	4.3	(82)

¹MR=projected risk as of 24 months after beginning BCS using standard actuarial risk projection methods based on data from NSS respondents. NSS respondents were interviewed between April 2011 and November 2012. Administrative data used to assess outcomes was obtained through March 2013, which means that the observed follow-up period was between 4 and 24 months.

²MST includes: rape, forcible sodomy, sexual assault, lewd acts with children, and incest.

Table 3. Concentration of risk of observed and projected administrative outcomes in the 10% of Army STARRS New Soldier Survey (NSS) respondents giving permission to link with administrative data who had highest predicted risk based on the initial machine learning models (n=21,825)

	The proportion of observed outcomes among the 10% of soldiers with highest predicted risk	Conditional risk in the 10% of new Soldiers with highest predicted risk compared to the other 90%			
		Top 10%		Other 90%	
		Observed ¹	Projected ¹	Observed ¹	Projected ¹
I. Sexual Trauma ²					
Perpetration (males only)	58.3	1.4	2.2	0.1	0.2
Victimization (females only)	37.4	9.9	16.0	1.8	2.9

¹The *observed* outcomes include the numbers that already occurred and appeared in the administrative records as of April 1, 2013. The *projected* outcomes, in comparison, include both the observed outcomes and additional outcomes that are would be likely to occur if all NSS respondents were followed for 24 months. The estimates of future outcomes are based on the actuarial onset curves reported in other slides.

²Sexual trauma includes: rape, forcible sodomy, sexual assault, lewd acts with children, and incest.

Figure 1. Cumulative first onset distributions within 180 months of joining the Army of two types of administratively recorded military sexual trauma (MST): perpetration of physical sexual military trauma and perpetration of verbal sexual military trauma separately for males and females Regular Army 2004-2009. Total number of person months is 37,023,063 (based on weighted sample) males =31,832,552 females=5,190,508

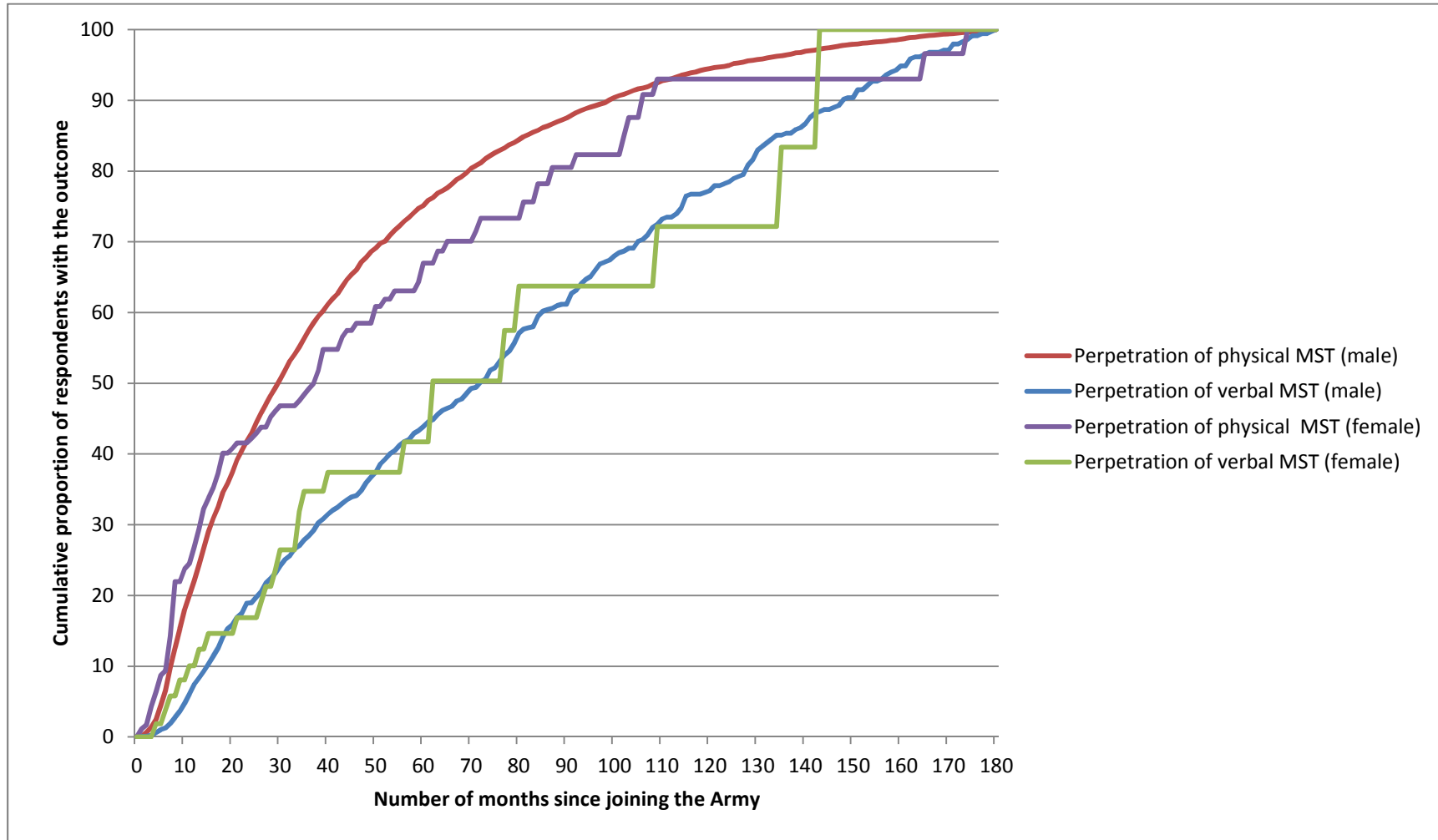


Figure 2. Cumulative first onset distributions within 180 months of joining the Army of two types of administratively recorded military sexual trauma (MST): victimization of physical sexual military trauma and victimization of verbal sexual military trauma separately for males and females Regular Army 2004-2009. Total number of person months is 37,023,063 (based on weighted sample) males =31,832,552 females=5,190,5

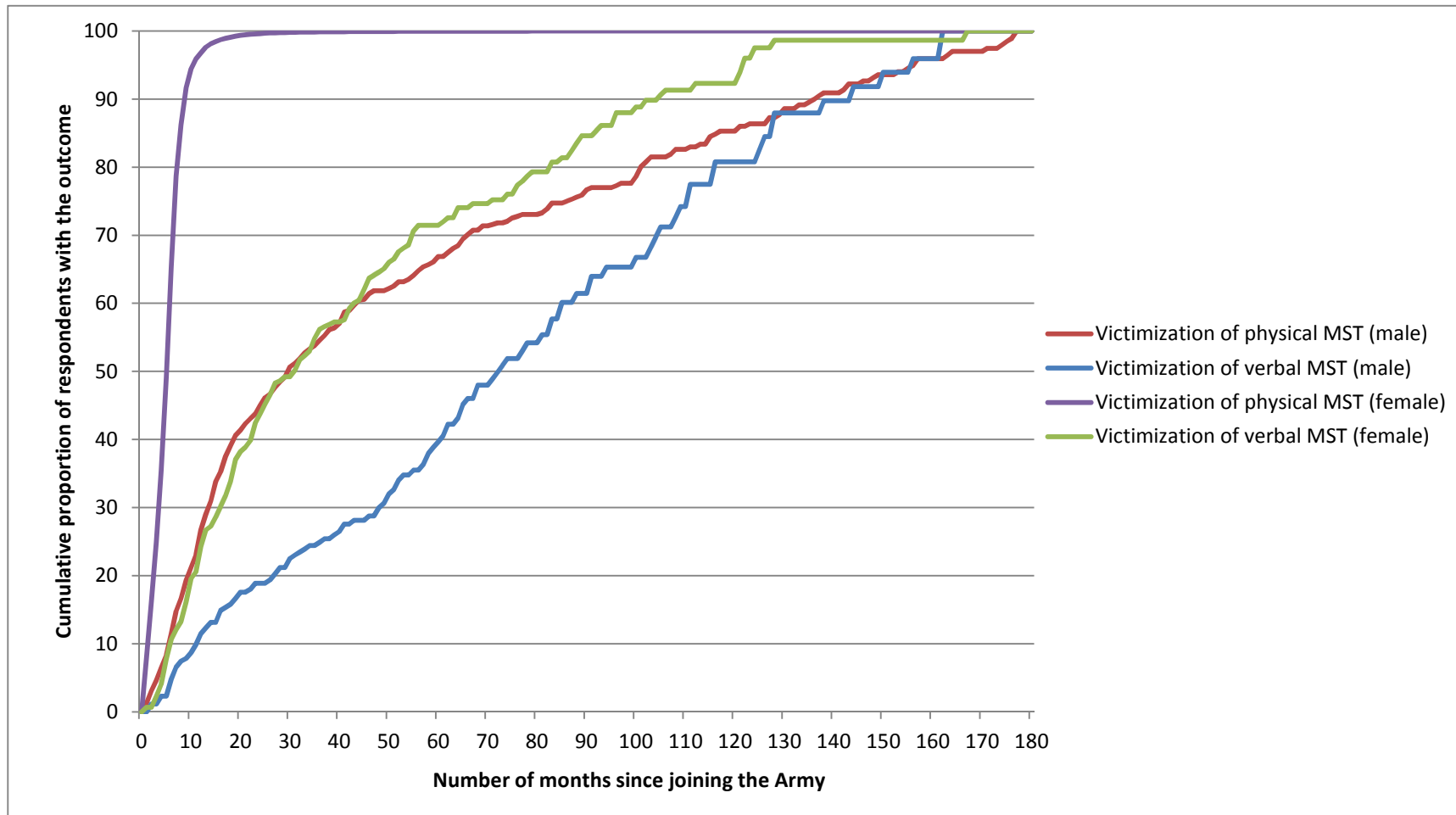
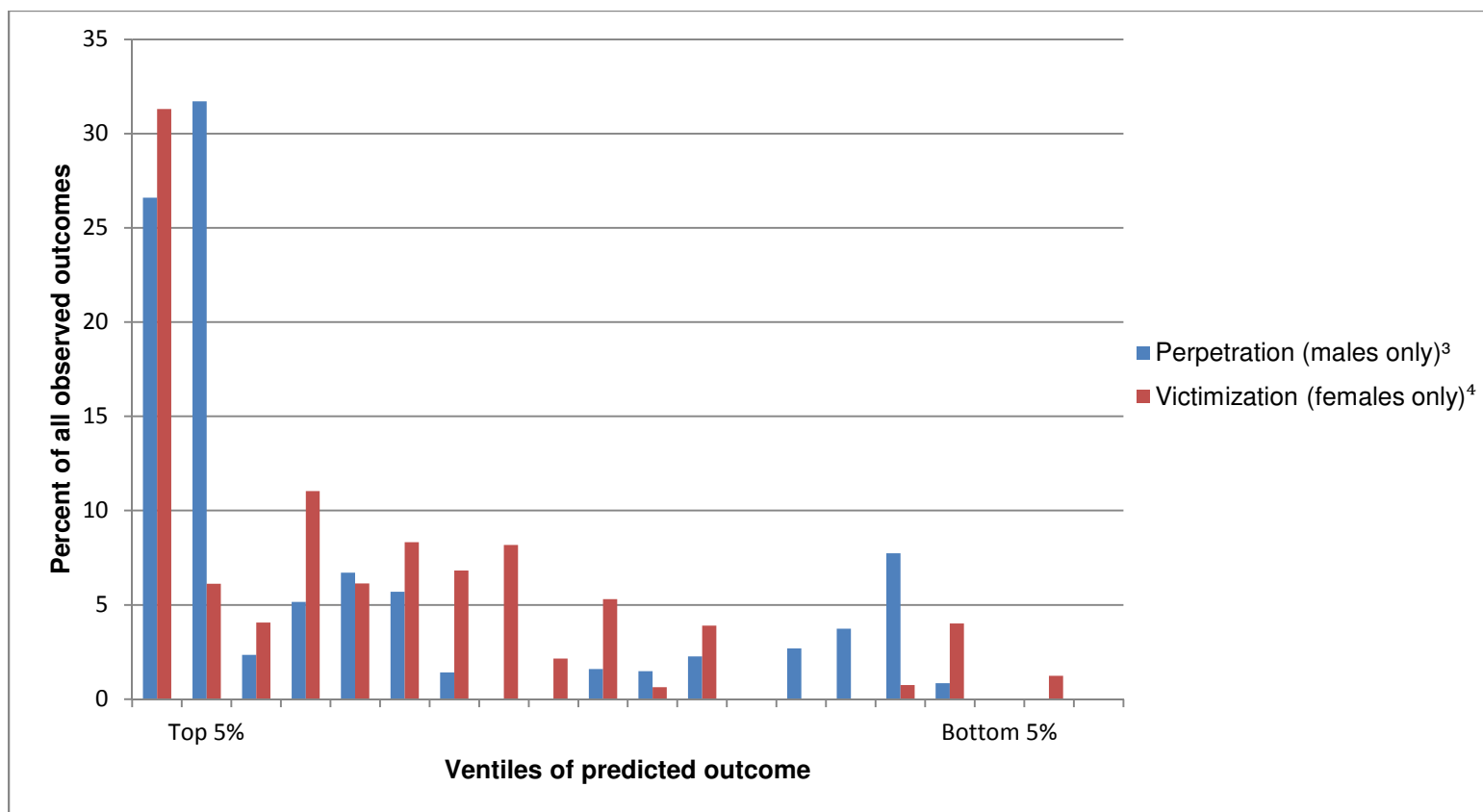


Figure 3. Concentration of risk of perpetrating sexual trauma (males only) and being a victim of sexual trauma (females only)¹ in the 24 months after enlistment based on initial machine learning models of Army STARRS New Soldier Survey (NSS) data, Regular Army 2011-2013² (n=21,825, n males = 18,861, n females = 2,964)



¹Sexual trauma includes: rape, forcible sodomy, sexual assault, lewd acts with children, and incest.

² Ventiles of predicted risk based on machine-learning models using NSS data to predict perpetration of sexual trauma (males only) and victimization of sexual trauma (females only) in the first 24 months of service.

³ n = 4